Winten Property Group

Commercial Development, 88 Christie Street, St Leonards

Desktop Study Report - Geotechnical and Groundwater

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Winten Property Group

Commercial Development, 88 Christie Street, St Leonards

Desktop Study Report - Geotechnical and Groundwater

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1 Introduction

Hyder Consulting has been commissioned by Winten Property Group to prepare a desk top study report on geotechnical and groundwater aspects in response to the Director General's Requirements for a Project Application for the site located at 88 Christie St, St Leonards.

The site is described as Lot50/DP3175, Lot4/DP560889, Lot71/DP542079, Lot72/DP542079, Lot10/DP3175, at Christie Street, St Leonards. The existing site is shown in Figure 1.

This report presents an assessment of the site geotechnical conditions and groundwater aspects. Our discussions and recommendations are made with respect to potential geotechnical issues that may arise from the subject site development. The possible design solutions and the potential impacts of the development on the adjacent buildings, infrastructure and utilities are discussed in this report. Also recommended are the groundwater related issues including the potential groundwater inflow towards the basement excavation and ongoing treatment of groundwater. The mitigation measures that may be employed to address the identified issues are discussed in the report.

Figure 1: Existing Site Location (*"AUSIMAGE © Sinclair Knight Merz Pty Ltd 2010"*)

2 Information Collected

At this desk top study level we have collected the following geotechnical and groundwater related information:

- Database search to assess the surface conditions
- Review of the geological map related to the subject site
- Geotechnical information search of the surrounding sites to appreciate the sub-surface ground conditions and the groundwater information
- A site walk over inspection and evaluation to identify any potential visible risks related to the proposed development

3 Surface Conditions

The proposed commercial building is to be located at the corner of Christie Street, Christie Lane and Lithgow Street, St Leonards. The existing ground falls from Christie Street to Lithgow Street, with a general trend of ground dipping down in a south and west direction.

The existing buildings have generally one level of car park, with two levels at the corner block of Christies Street and Christie Lane. Retaining walls were noted at the carpark level.

The North Shore Railway Line is close to the subject site to the west of the proposed development site as shown on Figure 1.

4 Sub-surface Conditions

4.1 Local Geology

The Sydney 1:100,000 Geological Sheet 9130 (1983) indicates that the site is close to or on the interface between Ashfield Shale and the underlying Hawkesbury Sandstone which is described as medium to coarse grained quartz sandstone with very minor shale and laminite lenses. At the interface between Ashfield shale and the Hawkesbury Sandstone the Mittogong Formation is also encountered and is characterised by the interbedded sandstones and shales.

At the subject site there could be fills and residual clays over weathered and interbedded sandstone and shale with fragmented zones and joints. At depth good quality sandstone bedrock is generally anticipated with some clay and shale seams present within better quality sandstone.

4.2 Previous Investigations

A number of geotechnical specialist consultants have established databases of their previous site investigation data. These were approached to determine whether their databases have information from developments in the vicinity of the subject site.

It was found that Jeffery and Katauskas Pty Ltd (J&K) carried out the original site investigation works for four sites within about 300m distance. A letter report by J&K dated 11 May 2010 outlined their findings of the sub-surface condition is presented in Appendix A of this report.

Based on the J&K report a summary of the sub-surface ground condition may be described as follows:

- Fill of varying thickness but is expected to be of the order of 1 to 2m.
- Residual soil of varying thickness but it may be anticipated to be of about 1 to 4m.
- Shale of varying weathering and strength overlying the Hawkesbury Sandstone.

As there is no site-specific information, the above profile could vary significantly from the adjacent sites.

4.3 Site Walkover

A site walkover inspection was carried out by Dr Jim Yang of Hyder Consulting. A visual inspection of the carpark basement was carried out to assess the exposed material at the base and side walls of the basement.

The following was noted during the site visit:

- Retaining walls were seen from some of the side of carpark basement/space.
- No soil or rock was exposed at the time of site inspection.
- Some seepage was observed from the retaining walls at the time of inspection as shown on Figure 2 and Figure3.
- A drain at the bottom of the retaining wall was noted to divert the seepage to the pits.

Figure 2: Observed groundwater seepage at the bottom of a retaining wall

Figure 3: Observed groundwater seepage at the bottom of a retaining wall

4.4 Groundwater

Based on our site observation and the information provided by J&K from the following can be interpreted:

- Groundwater table is likely to be at or below the existing basement level, possibly at a depth of 3 to 6m.
- “Shallow” seepage may originate from the perched water within the soils behind the retaining walls although the source of water is unknown.
- Groundwater is likely to be present predominantly within the rock defects in the rock mass.

The quality of the groundwater is unknown at the time of writing this report.

We understand from Winten Property Group that there are 9 levels of basement at the constructed Forum development site which is referred as Site 4 in J&K report. The groundwater table of the subject site may have already been drawn down by the deep basement at the Forum site as it is only about 150m away.

5 Proposed Development

A set of concept development plans and sections are provided to Hyder Consulting by Winten Property Group. A concept plan at ground and a typical cross sections prepared by BatesSmart are presented in Appendix B. The proposed development is primarily for commercial use with the tower being 17 levels (about 75m) above the ground level. Up to 7 levels of basement for car parking is proposed. The typical cross-section shows that the proposed excavation at the Lithgow Street is about 19m and about 22m at Christies Street respectively.

6 Geotechnical Issues and Recommendations

The proposed basement excavation of the order of 19m to 22m depth is likely to draw down the existing ground water level down if a “drained” basement is to be constructed.

Near vertical excavation in soil and residual as well as the very low strength shale or sandstone will require shoring system during construction and for the long term stability. Particular attention should be paid to the deep weathering of shale encountered at the adjacent sites. Excavation within the good quality can be near vertical with localised rock support.

Based on our evaluation of the collected information and our past similar project experience we consider that the proposed development is feasible at this concept stage from geotechnical and groundwater perspectives. However we anticipate that the following key issues related to geotechnical and groundwater aspects should be considered in the post concept design development and construction:

1 Noise and vibration – There are two sources of noise and vibration. The first one is anticipated from demolition works of the existing building. The second one is expected to be from the excavation works for the basement. These activities may have a potential adverse impact on the adjacent buildings and people working or living in these buildings. Appropriate design and construction methodologies can be developed to mitigate these issues.

2 Services and utilities will need to be identified and relocated if required prior to demolishing and excavation works.

3 Retaining or shoring system may be required for the existing building during demolition and for the excavation of the basement levels to ensure structural integrity of the adjacent buildings and basements.

4 There could be potential geotechnical and groundwater related impacts of the development on the existing North Shore Railway Line. These can be assessed during design development and appropriate mitigation measures can be undertaken if required.

5 Temporary and/or permanent shoring system will be required to retain the soil and residual as well as the weak shale overlying the good quality sandstone so that the basement excavation can be carried out in a safe manner.

6 Groundwater inflow is likely to be encountered during basement excavation. The volume and quality of the groundwater will depend upon the characteristics of the defects within the rock mass and the water recharge source.

7 Ground movement may occur due to stress relief resulting from the basement excavation. The magnitude of movement is dependent upon the lock in stresses within the rock mass. It often occurs in a sudden and rapid manner, which may lead to instability of the excavated rock face and cracking /movement in slabs of the adjacent buildings as well as the utilities and underground services such as water mains. Appropriate design solutions and construction methodologies can be developed to mitigate these issues.

8 Any significant geological features such as water-bearing dyke intersecting the project site or in the close vicinity of the subject site that may have an impact on the development should be identified and considered.

In order to address the above key issues we recommend that a comprehensive geotechnical site investigation be carried out after the concept plan approval but prior to detail design and development. The geotechnical investigation plan should be designed such that the identified key issues will be appropriately addressed.

Appendix A

Letter Report from J&K

Jeffery and Katauskas Pty Ltd

CONSULTING GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS
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11 May, 2010
Ref: 24004WNlet

Hyder Consulting Pty Ltd
Level 45, 141 Walker Street
NORTH SYDNEY NSW 2060

ATTENTION: Dr Jim Yang

Dear Sir

DESKTOP STUDY
PROPOSED DEVELOPMENT
88 CHRISTIE STREET, ST LEONARDS, NSW

This letter reports the results of a desktop study for the proposed development at 88 Christie Street St Leonards, NSW. The study was commissioned by Dr Jim Young of Hyder Consulting Pty Ltd by email dated 6 May 2010 and was carried out as outlined in our email dated 5 May 2010.

From email correspondence with Dr Jim Young of Hyder consulting Pty Ltd, we understand that a Part 3 application is being made for a proposed development at the above address. For this application, information is required on anticipated subsurface conditions, both geotechnical and hydrogeological.

The scope of this study was limited to providing existing subsurface information from previous investigations completed on nearby sites.

NEARBY SITES IDENTIFIED

The following nearby sites were identified from our database as having relevant subsurface information obtained during previous geotechnical investigations:

Site 1: Albany Street – approximately 300m to the east of the site.

Site 2: Pacific Highway – approximately 200m to the east of the site.

Site 3: Lithgow Street – approximately 50m to the south of the site.

Site 4: Forum Development, north side of Pacific Highway – approximately 150m north of the site.

Details of the investigations carried out and the subsurface conditions encountered are discussed below. A selection of borehole logs for the above sites have also been included with this letter. The approximate location of the subject site and the nearby sites is shown on the attached Figure 1.

INVESTIGATION DETAILS AND SUBSURFACE CONDITIONS

Site 1

The elevation of site 1 is significantly higher than the subject site, being located uphill towards crows nest.

Two boreholes (BH1 and BH2) were drilled on this site to a maximum depth of 18m. BH2 was diamond cored from a depth of 7.5m and a copy of the borehole log is attached.

Fill was encountered in both boreholes to a maximum depth of 1.2m

Residual silty clay was encountered from beneath the fill to depths of 2.8m and 4m.

Interbedded weathered shale and sandstone bedrock was encountered from beneath the residual silty clay in both boreholes. The bedrock was generally extremely

weathered and of extremely low strength, or distinctly weathered and of very low strength. Some higher strength (typically very low to low strength) bands were encountered within the poorer quality bedrock profile.

Minor seepage was encountered at a depth of 10.5m in BH1, however, both boreholes were 'dry' on completion of augering. No piezometers were installed to allow for ongoing groundwater monitoring.

Site 2

Three boreholes (BH1, BH2 and BH3) were drilled to depths between 14.65m and 24.20m using spiral augering and diamond coring techniques. Borehole logs for BH1 and BH3 are attached.

Surficial fill was encountered in all of the boreholes to depths between 0.4m and 0.8m.

Residual silty clay was encountered from beneath the fill to depths between 1.7m and 2.5m.

Deeply weathered shale of extremely low and very low strength was encountered in all of the boreholes to depths between 9.4m and 16.0m. The deeper shale in one of the boreholes was interbedded with silty clays of hard strength.

In BH1, medium strength shale was encountered below a depth of 11.5m, and high strength shale below a depth of 12.4m. Core loss was experienced in this hole between 11.8m and 12.4m depth.

In BH2, the shale was of extremely low and very low strength to the depth of termination at 14.65m.

In BH3, extremely low strength sandstone was encountered from a depth of 16.0m and sandstone bedrock of high strength from a depth of 21.1m to termination at 24.2m depth.

Groundwater seepage was encountered in BH3 at a depth of 7.2m during augering. BH1 and BH2 were 'dry' during augering. No piezometers were installed to allow for ongoing groundwater monitoring.

Site 3

Five boreholes (BH1 to BH5) were drilled to depths between 9.0m and 11.5m. Three boreholes (BH6 to BH8) were subsequently drilled to a depth of 4.5m. All of the boreholes were drilled using spiral augering techniques only. Borehole logs for BH1 and BH4 are attached.

The five initial boreholes disclosed the following profile:

- Fill to depths between 0.3m and 2.2m.
- Residual clays to between 1.1m and 4.2m depth.
- Sandstone bedrock below this. The upper approximately 3m were generally highly weathered and of very low strength, with medium strength sandstone below this. Shale bands were encountered in some of the sandstone bedrock.
- Groundwater was present at depths between 3.6m and 6.6m on completion of the fieldwork.

The three subsequent boreholes disclosed the following subsurface profile:

- Surficial fill to a maximum depth of 0.4m.
- Residual clays to a depths between 1.8m and 1.8m
- Sandstone bedrock below the residual clays. The upper 0.4m to 0.6m was extremely weathered and of extremely low strength, with less weathered and higher strength sandstone bedrock encountered below this.

- All of the boreholes were 'dry' during and on completion of drilling.

No piezometers were installed to allow for ongoing groundwater monitoring.

Inspections of the cut faces during excavation showed the subsurface profile to be highly variable, with numerous extremely weathered bands and clay bands within the sandstone bedrock strata. The cut faces required significant stabilisation treatment in some areas. Some record photographs of the excavation faces are attached.

Site 4

Twenty two boreholes (BH1 to BH22) were drilled by others to depths between 1.4m and 5.0m using spiral augering techniques. A number of the boreholes were extended to a maximum depth of 23.1m using diamond coring techniques. The surface RL of the boreholes varied between 74.4m and 79.9m, datum unknown.

Fill and residual silty clay was encountered in all of the boreholes to RLs between 69.4m and 78.6m.

Highly weathered shale with variable strength sandstone bands was encountered in two of the boreholes to RLs of 72.5m and 72.0m.

Variable strength sandstone was encountered across the site to RLs between 58.6m and 70.5m. The sandstone generally comprised interbedded layers of extremely low to very low strength and medium to high strength sandstone. Some extremely weathered shale bands were also present within this sandstone.

Better quality sandstone bedrock of medium o high strength was encountered below the variable quality sandstone bedrock. Some minor extremely low strength shale lenses were present within he better quality sandstone.

Groundwater was encountered in two of the boreholes at depths between 4.1m and 6.0m. No piezometers were installed to allow for ongoing groundwater monitoring.

OVERVIEW

The 1:100,000 Geological Map of Sydney indicates that the site lies close to or on the interface between Ashfield Shale and the underlying Hawkesbury Sandstone. At this interfaces the Mittagong formation is also encountered and is characterised by interbedded sandstones and shales.

The upper profile encountered was variable with residual clays over weathered shale and interbedded sandstone and shale with fragmented zones and joints. At depth, good quality sandstone bedrock is generally anticipated though some clay and shale seams will likely be present within the better quality sandstone.

Seepage would be expected from the upper profile, say about 3m to 5m depth.

GENERAL COMMENTS

Occasionally, the subsurface conditions between the completed boreholes may be found to be different (or may be interpreted to be different) from those expected. Variation can also occur with groundwater conditions, especially after climatic changes. If such differences appear to exist, we recommend that you immediately contact this office.

This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose. Copyright in this report is the property of Jeffery and Katauskas Pty Ltd. We have used a degree of care, skill and diligence normally exercised by consulting engineers in similar circumstances and locality. No other warranty expressed or implied is made or intended. Subject to payment of all fees due for the investigation,

the client alone shall have a licence to use this report. The report shall not be reproduced except in full.

Should you require any further information regarding the above please do not hesitate to contact the undersigned.

Yours faithfully
For and on behalf of
JEFFERY AND KATAUSKAS PTY LTD

Nicholas Smith
Geotechnical Engineer

Bruce Walker
Principal.

Encl: Borehole Logs from Nearby Sites (5 boreholes)
Figure 1: Sketch Plan Showing Approximate Location of Subject Site and Nearby Sites
Record Photographs from Site 3

Jeffery and Katauskas Pty Ltd
CONSULTING GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

Borehole No. 2 1/4

BOREHOLE LOG

Client:

Project: PROPOSED DEVELOPMENT

Location: SITE 1

Job No. 16186W **Method:** SPIRAL AUGER JK250 **R.L. Surface:** ≈ 85.0m

Date: 29-7-02 **Datum:** AHD

Logged/Checked by: A.M./ BPC

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
						0			FILL: Silty clay, low plasticity, dark brown, with a trace of sand.	D			
									CONCRETE: 60mm.t.				50mm DIAMETER REINFORCEMENT AT 40mm TOP COVER
									FILL: Silty clay, low plasticity, brown, with a trace of sandstone and ironstone gravel.	MC > PL			
						1		CH	SILTY CLAY: high plasticity, light grey mottled red brown.	MC > PL	VSt	-	RESIDUAL
					N = 16 4,7,9							380	
												310	
											H	280	
						2						> 600	
												> 600	
								-	SHALE: light grey and grey brown.	DW	L		LOW 'TC' BIT RESISTANCE
						3							
						4			as above, but with occasional ironstone bands.				
									as above, but dark grey.				
						5							
						6					L-VL		LOW TO VERY LOW RESISTANCE
						7							

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Borehole No. 2 2/4

BOREHOLE LOG

Client:

Project: PROPOSED DEVELOPMENT

Location: SITE 1

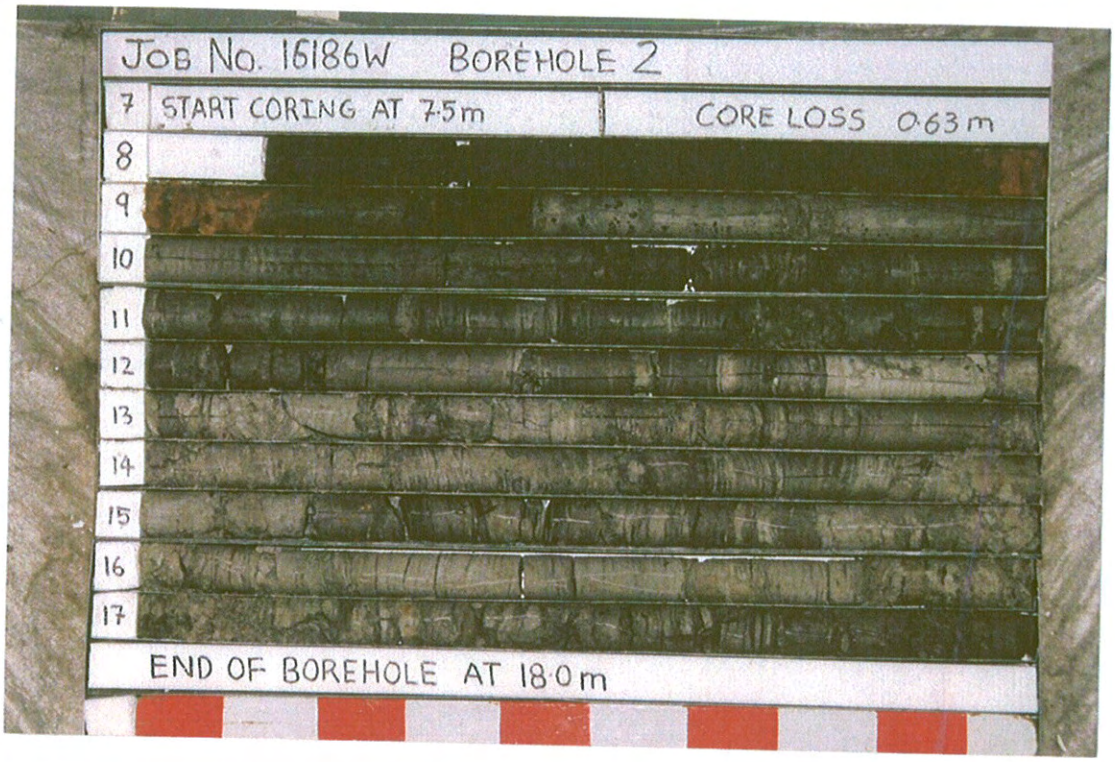
Job No. 16186W **Method:** SPIRAL AUGER JK250 **R.L. Surface:** ≈ 85.0m

Date: 29-7-02 **Datum:** AHD

Logged/Checked by: A.M./

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
				■					SHALE: dark grey.	DW	L-VL		VERY LOW TO LOW RESISTANCE
									REFER TO CORED BOREHOLE LOG				
						8							
						9							
						10							
						11							
						12							
						13							
						14							

SITE 1


JOB No. 16186W BOREHOLE 2
7 START CORING AT 7.5m
CORE LOSS 0.63m
8
9
10
11
12
13
14
15
16
17
END OF BOREHOLE AT 18.0m

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CORED BOREHOLE LOG

Borehole No. 2 3/4

Client:

Project: PROPOSED DEVELOPMENT

Location: SITE 1

Job No. 16186W **Core Size:** NMLC **R.L. Surface:** ≈ 85.0m

Date: 29-7-02 **Inclination:** VERTICAL **Datum:** AHD

Drill Type: JK250 **Bearing:** - **Logged/Checked by:** A.M.

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION (Rock Type, grain characteristics, colour, structure, minor components.)	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_S(50)$ (EL VL L M H VH EH)	DEFECT DETAILS: DEFECT SPACING (mm) (500 300 100 50 30 10)	DEFECT DETAILS: DESCRIPTION Type, inclination, thickness, planarity, roughness, coating. Specific / General
		7		START CORING AT 7.5m					
				CORE LOSS: 0.63m					
		8		SHALE: dark grey.	XW	EL			
					DW	VL			
					XW	EL			
		9		SILTY CLAY: high plasticity, light brown.					HP READINGS:- 480, 440, 500
				as above, but grey.	DW	VL			
				SHALE: dark grey.	XW	EL-VL			
				SHALE: light grey.					
		10							
				INTERBEDDED SANDSTONE: fine grained, light grey, and SHALE: grey.					
		11							
		12							
FULL RET-URN		13							
				as above, but with occasional bands of very low strength sandstone, 30-100mm.t.					

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Borehole No. 2 4/4

CORED BOREHOLE LOG

Client:

Project: PROPOSED DEVELOPMENT

Location: SITE 1

Job No. 16186W **Core Size:** NMLC **R.L. Surface:** ≈ 85.0m

Date: 29-7-02 **Inclination:** VERTICAL **Datum:** AHD

Drill Type: JK250 **Bearing:** - **Logged/Checked by:** A.M. Bird

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, structure, minor components.	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_S(50)$ EL VL L M H VH EH	DEFECT DETAILS DEFECT SPACING (mm) 600 300 100 50 30 10	DESCRIPTION Type, inclination, thickness, planarity, roughness, coating. Specific / General
		15		INTERBEDDED SANDSTONE AND SHALE: as above	XW	EL-VL			
		16		SANDSTONE: fine grained, light grey with dark grey laminae at 5-10mm spacings.	DW	VL / L			- XWS, 90mm t.
		17		INTERBEDDED SANDSTONE: fine grained, light grey, and SHALE: grey.	XW	EL-VL			
		18		END OF BOREHOLE AT 18.0m					
		19							
		20							

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BOREHOLE LOG

Borehole No. 1 1/3

Client:

Project: PROPOSED COMMERCIAL/RESIDENTIAL DEVELOPMENT

Location: SITE 2

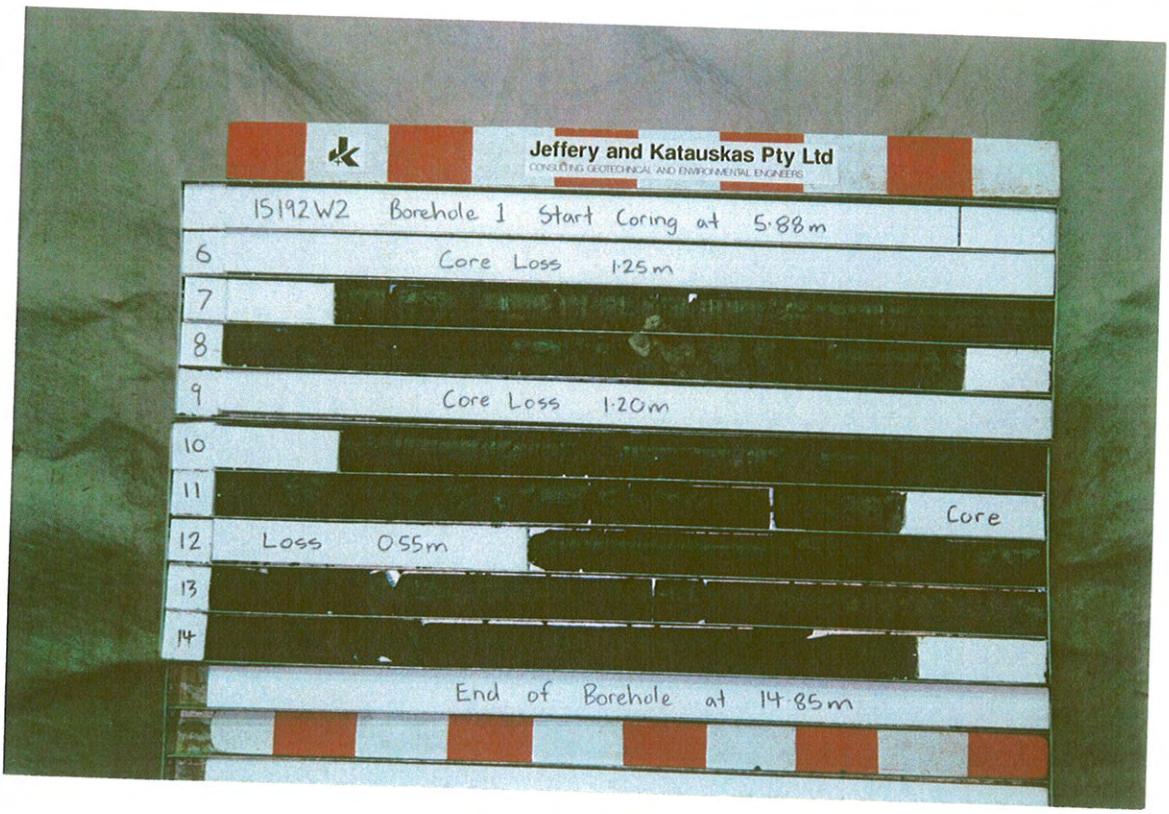
Job No. 15192WZ **Method:** SPIRAL AUGER INTERTECH 550 **R.L. Surface:** ~93.3m

Date: 10-6-00 **Datum:** ASSUMED

Logged/Checked by: S.P./[illegible]

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION OF AUGERING					PID=0.0	0		–	ASPHALTIC CONCRETE: 30mm.t	MC<PL	(H)	–	–
									FILL: Gravelly silty clay, low plasticity, mottled red brown and dark grey, with a trace of sand.				
					N = 11 4,4,7 PID=0.0			CH	SILTY CLAY: high plasticity, red brown.	MC>PL	VSt-H	250 310 480	RESIDUAL
						1			as above, but pale grey mottled red brown, with a trace of medium grained ironstone gravel.	MC<PL	H		
					N = 19 6,8,11							>600 510 >600	
						2							
								–	SHALE: brown and grey.	XW	EL-VL	–	VERY LOW 'TC' BIT RESISTANCE
					SPT 3/10mm R	3							LOW RESISTANCE
									as above, but dark grey, with pale grey laminae.				
						4							
						5							
						6			REFER TO CORED BOREHOLE LOG				
						7							

SITE 2


Jeffery and Katauskas Pty Ltd
CONSULTING GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS
15192W2 Borehole 1 Start Coring at 5.88m
6
Core Loss 1.25m
7
8
9
Core Loss 1.20m
10
11
Core
12
Loss 0.55m
13
14
End of Borehole at 14.85m

Jeffery and Katauskas Pty Ltd
CONSULTING GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

Borehole No. 1 2/3

CORED BOREHOLE LOG

Client:

Project: PROPOSED COMMERCIAL/RESIDENTIAL DEVELOPMENT

Location: SITE 2

Job No. 15192WZ **Core Size:** NMLC **R.L. Surface:** ~93.3m

Date: 10-6-00 **Inclination:** VERTICAL **Datum:** ASSUMED

Drill Type: INTERTECH 550 **Bearing:** - **Logged/Checked by:** S.P./

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, structure, minor components.	Weathering	Strength	POINT LOAD INDEX STRENGTH $I_s(50)$ (EL VL L M H VH EH)	DEFECT DETAILS: DEFECT SPACING (mm) (500 300 100 50 30 10)	DEFECT DETAILS: DESCRIPTION Type, inclination, thickness, planarity, roughness, coating. Specific / General
		5		START CORING AT 5.88m					
		6		CORE LOSS 1.25m					
		7		SHALE: dark grey with pale grey laminae bedded at 0°.	XW	EL-VL	×		- Be, 0°, IS
		8					×		- Be, 0°, IS - Be, 0°, IS - Be, 0°, IS
FULL RET-URN		9		CORE LOSS 1.20m			×		
		10		SHALE: dark grey, bedded at 0°.	DW	VL-L	×		- J, 40°, P, S
		11			XW	EL			- J, 70-90°, P, S - CS, 0°, 30mm.t - CS, 0°, 10mm.t - CS, 0°, 20mm.t - CS, 0°, 20mm.t
					DW-SW	M	×		
		12		CORE LOSS 0.55m					

Jeffery and Katauskas Pty Ltd
CONSULTING GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

Borehole No. 1 3/3

CORED BOREHOLE LOG

Client:

Project: PROPOSED COMMERCIAL/RESIDENTIAL DEVELOPMENT

Location: SITE 2

Job No. 15192WZ **Core Size:** NMLC **R.L. Surface:** ~93.3m

Date: 10-6-00 **Inclination:** VERTICAL **Datum:** ASSUMED

Drill Type: INTERTECH 550 **Bearing:** – **Logged/Checked by:** S.P./

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, structure, minor components.	Weathering	Strength	POINT LOAD INDEX STRENGTH $I_s(50)$ (EL VL L M H VH EH)	DEFECT DETAILS: DEFECT SPACING (mm) (500 300 100 50 30 10)	DESCRIPTION: Type, inclination, thickness, planarity, roughness, coating. Specific / General
		12		CORE LOSS					
FULL RET-URN		13		SHALE: dark grey.	DW-SW	H			- J, 80°, P, S - J, 75°, P, S - XWS, 0°, 20mm.t.
		14							- J, 45°-90°, P, S - J, 75°, P, S
		15		END OF BOREHOLE AT 14.85m					
		16							
		17							
		18							

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CONSULTING GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS

BOREHOLE LOG

Borehole No. 3 1/4

Client:

Project: PROPOSED COMMERCIAL/RESIDENTIAL DEVELOPMENT

Location: SITE 2

Job No. 15192WZ
Date: 12-6-00
Method: SPIRAL AUGER INTERTECH 550
Logged/Checked by: P.R./
R.L. Surface: ~91.3m
Datum: ASSUMED

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
						0			CONCRETE: 100mm.t				
					PID=0.0			-	FILL: Silty clay, medium plasticity, brown and grey, with fine to medium grained igneous and shale gravel.	MC=PL	-	-	-
					N = 7 3,3,4 PID=0.0			CH	SILTY CLAY: high plasticity, brown and red brown, with a trace of fine to medium grained sub-rounded shale and ironstone gravel.	MC<PL	VSt-H	400 340 220	RESIDUAL
						1							
					N > 10 10,10/ 40mm R				as above, but mottled grey with friable bands.		H	450 440	
								-		XW-DW	L		
						2			SHALE: grey, with thin high strength ironstone bands.				LOW 'TC' BIT RESISTANCE
									SHALE: grey and brown, with thin bands of silty clay of high plasticity, and brown mottling.		VL		
						3							
						4							
						5							
						6			as above, but with extremely strength low bands.	XW			VERY LOW TO LOW RESISTANCE
						7							

AFTER PULLING ROTARY CASING

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BOREHOLE LOG

Borehole No. 3 2/4

Client:

Project: PROPOSED COMMERCIAL/RESIDENTIAL DEVELOPMENT

Location: SITE 2

Job No. 15192WZ **Method:** SPIRAL AUGER INTERTECH 550 **R.L. Surface:** ~91.3m

Date: 12-6-00 **Datum:** ASSUMED

Logged/Checked by: P.R./

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
						7			SHALE: as above.	XW	VL		
						8		CH	SILTY CLAY: high plasticity, dark grey, with a trace of thin bands of extremely weathered, extremely low strength shale.	MC<PL	(VSt-H)		NO DRILLING RESISTANCE
					SPT 20/ 150mm R	9		–	SHALE/SILTY CLAY: dark grey, high plasticity.	MC<PL/ XW	H/ EL	>600 >600	OCCASIONAL BANDS OF VERY LOW RESISTANCE
					N > 14 15,14/ 100mm R	10						>600 >600 >600	
						11							
					N > 37 10,17, 20/ 100mm R	12						>600 >600 >600	WITH THIN FRIABLE BANDS
						13							

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Borehole No. 3 3/4

BOREHOLE LOG

Client:)

Project: PROPOSED COMMERCIAL/RESIDENTIAL DEVELOPMENT

Location: SITE 2

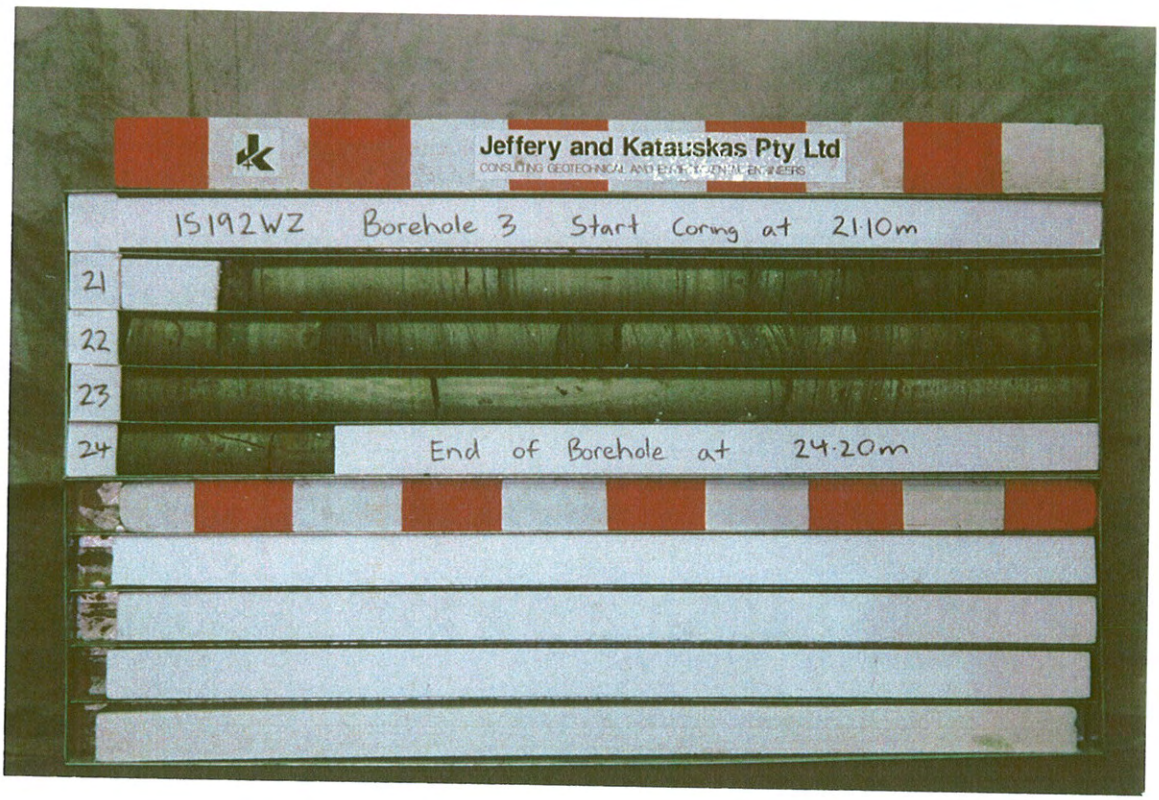
Job No. 15192WZ **Method:** SPIRAL AUGER INTERTECH 550 **R.L. Surface:** ~91.3m

Date: 12-6-00 **Datum:** ASSUMED

Logged/Checked by: P.R.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
						14			SHALE/SILTY CLAY: dark grey, high plasticity.	MC<PL/ XW	H/ EL		
						15							
					SPT 23/ 100mm R	16		–	SANDSTONE: fine grained, light grey.	XW	EL	–	–
						17							THIN BANDS OF LOW RESISTANCE
						18				XW~DW	L-M		BANDS OF LOW TO MODERATE RESISTANCE
						19							
						20			REFER TO CORED BOREHOLE LOG	XW	EL		VERY LOW RESISTANCE

SITE 2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15192WZ Borehole 3 Start Coring at 21.10m
21
22
23
24
End of Borehole at 24.20m

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CORED BOREHOLE LOG

Borehole No. 3 4/4

Client:

Project: PROPOSED COMMERCIAL/RESIDENTIAL DEVELOPMENT

Location: SITE 2

Job No. 15192WZ **Core Size:** NMLC **R.L. Surface:** ~91.3m

Date: 12-6-00 **Inclination:** VERTICAL **Datum:** ASSUMED

Drill Type: INTERTECH 550 **Bearing:** - **Logged/Checked by:** P.R.

Water Loss/Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, structure, minor components.	Weathering	Strength	POINT LOAD INDEX STRENGTH $I_s(50)$ EL VL L M H VH EH	DEFECT DETAILS DEFECT SPACING (mm) 500 300 100 50 30 10	DESCRIPTION Type, inclination, thickness, planarity, roughness, coating. Specific / General
		20							
		21		START CORING AT 21.1m					
FULL RETURN		22		SANDSTONE: fine grained, light grey, bedded at 0° to 10°.	DW	H	×		- CS, 0°, 8mm.t - LAMINATED BAND, 0°, 25mm.t - 2 J, 55°, P, R, 25mm SPACING - CS, 0°, 55mm.t, HP = >600kPa
		23					×		- Cr, 10°, 10mm.t
		24					×		- XW BAND, 10°, 5mm.t - J, 70°, P, R
				END OF BOREHOLE AT 24.2m					
		25							
		26							
		27							

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BOREHOLE LOG

Borehole No. 1 1/2.

Client:
Project: 729 CLUB DEVELOPMENT
Location: SITE 3

Job No. 5120 JW
Date: 11·6·87

Method: SPIRAL AUGER
HYDRAPOWER RIG

Groundwater record	Samples	FIELD TESTS	Depth (m.)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition	Consistency/ Rel. Density	Hand Penetrometer Readings kPa.	Remarks
			1			FILL: sandy clay, low plasticity, yellowish brown and brown, fine to medium grained sand with a trace of gravels, root fibres and charcoal fragments	MC≈PL	V.St		
	D.S.	N = 11 4, 5, 6							360 370 350 370	
			2							
	D.S.	N = 8 4, 4, 4			CL-CH	CLAY: medium - high plasticity, orange brown and yellow brown with some fine grained sand and trace of root fibres	MC≈PL	V.St H	320 380 390 540 540	
			3		CL	SILTY SANDY CLAY: low plasticity, whitish brown fine to medium grained sand.				RESIDUAL
	D.S.	N = 28 4, 18, 10/100 mm				as above, but with some ironstone bands.			320 300 350 500	ESTIMATED 'V' BIT REFUSAL
▽ AFTER 4½ hrs	D.S.		4			SANDSTONE: fine to medium grained, whitish brown, highly weathered, weak, some ironstone bands.				MODERATE 'TC' BIT RESISTANCE WITH SOME WEAK BANDS
			5			as above, but greyish white, moderately weathered, weak - medium strong				MODERATE TO HIGH 'TC' BIT RESISTANCE
			6			as above, but medium strong, occasional interbedded weak shale bands				HIGH 'TC' BIT RESISTANCE WITH SOME MODERATE BANDS.
			7							

JEFFERY AND KATAUSKAS PTY. LTD.

BOREHOLE LOG

Borehole No. 1. 2/2

Client:
Project: 729 CLUB DEVELOPMENT
Location: SITE 3

Job No. 5120 JW
Date: 11·6·87
Method: SPIRAL AUGER HYDRAPOWER RIG

Groundwater record	Samples	FIELD TESTS	Depth (m.)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition	Consistency/ Rel. Density	Hand Penetrometer Readings kPa.	Remarks
	D.S.		7			SANDSTONE: fine to medium grained, greyish white, moderately weathered, medium strong, occasional weak shale bands				HIGH 'TC' BIT RESISTANCE WITH OCCASIONAL MODERATE BANDS.
			8							
			9			as above, but greyish white, moderately weathered, medium strong.				HIGH 'TC' BIT RESISTANCE
			10							
			11							
	D.S.		11·5m							
			12			END OF BOREHOLE				
			13							

JEFFERY AND KATAUSKAS PTY. LTD.

BOREHOLE LOG

Borehole No. 4. 1/2

Client:
Project: 729 CLUB DEVELOPMENT
Location: SITE 3

Job No. 5120 JW
Date: 11·6·87

Method: SPIRAL AUGER
HYDRAPOWER RIG

Groundwater record	Samples	FIELD TESTS	Depth (m.)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition	Consistency/ Rel. Density	Hand Penetrometer Readings kPa.	Remarks
						BITUMEN LAYER				
						FILL: sandy clay, low plasticity, dark brown				
					CL	SANDY CLAY: low to medium plasticity, yellowish brown and orange brown, fine to medium grained sand, with some ironstone gravels	MC<PL	H	400 420 >600 >600 >600	ESTIMATED 'V' BIT REFUSAL
	D.S.	N=26 11,12,14	1							
						SANDSTONE: fine grained, whitish grey and light grey, extremely weathered, very weak with interbedded ironstone bands.				MODERATE 'TC' BIT RESISTANCE WITH HIGH BANDS
			2							
	D.S.		3							
			4			as above, but fine to medium grained, light grey, highly weathered, weak to medium strong with some ironstone bands.				HIGH 'TC' BIT RESISTANCE WITH MODERATE BANDS
			5							
	D.S.		6			as above, but medium strong with occasional shale bands.				HIGH 'TC' BIT RESISTANCE WITH OCCASIONAL MODERATE BANDS
▼ AFTER 1hour			7							

JEFFERY AND KATAUSKAS PTY. LTD.

BOREHOLE LOG

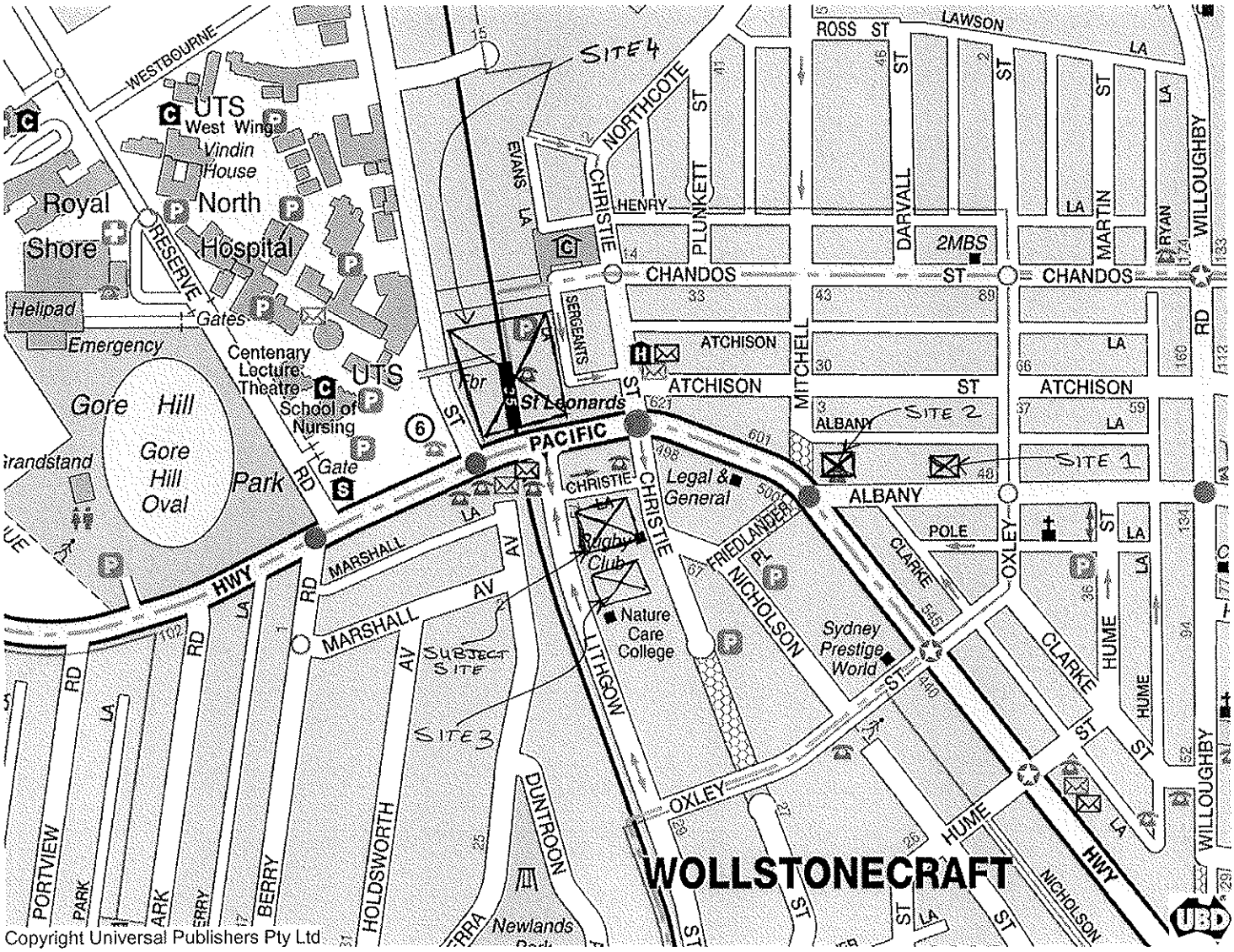
Borehole No. 4 2/2

Client:
Project: 729 CLUB DEVELOPMENT
Location: SITE 3

Job No. 5120 JW
Date: 11·6·87

Method: SPIRAL AUGER HYDRAPOWER RIG

Groundwater record	Samples	FIELD TESTS	Depth (m.)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition	Consistency/ Rel. Density	Hand Penetrometer Readings kPa.	Remarks
			7			SANDSTONE : as above				HIGH 'TC' BIT RESISTANCE WITH OCCASIONAL MODERATE BANDS
			8							
	D.5.		9.0m							
			9			END OF BOREHOLE				
			10							
			11							
			12							
			13							

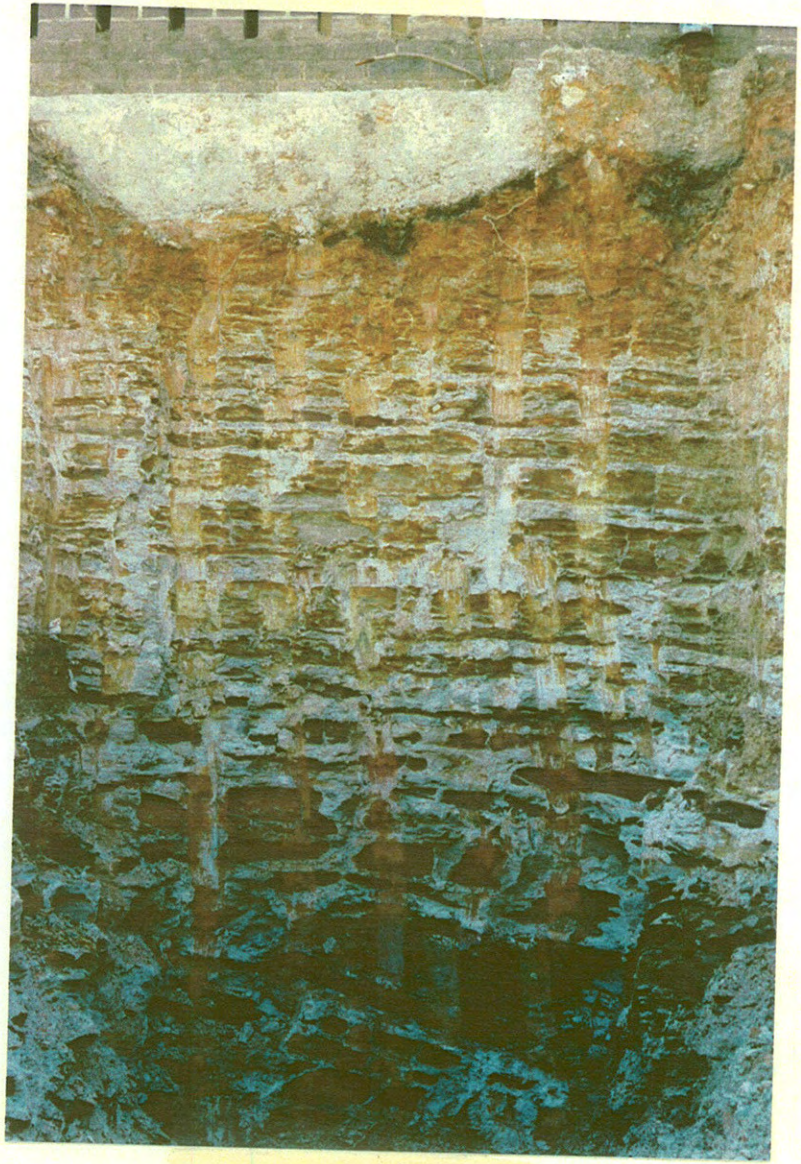


SKETCH PLAN SHOWING APPROXIMATE LOCATION OF SUBJECT SITE AND NEARBY SITES.

NOT TO SCALE

Jeffery and Katauskas Pty Ltd

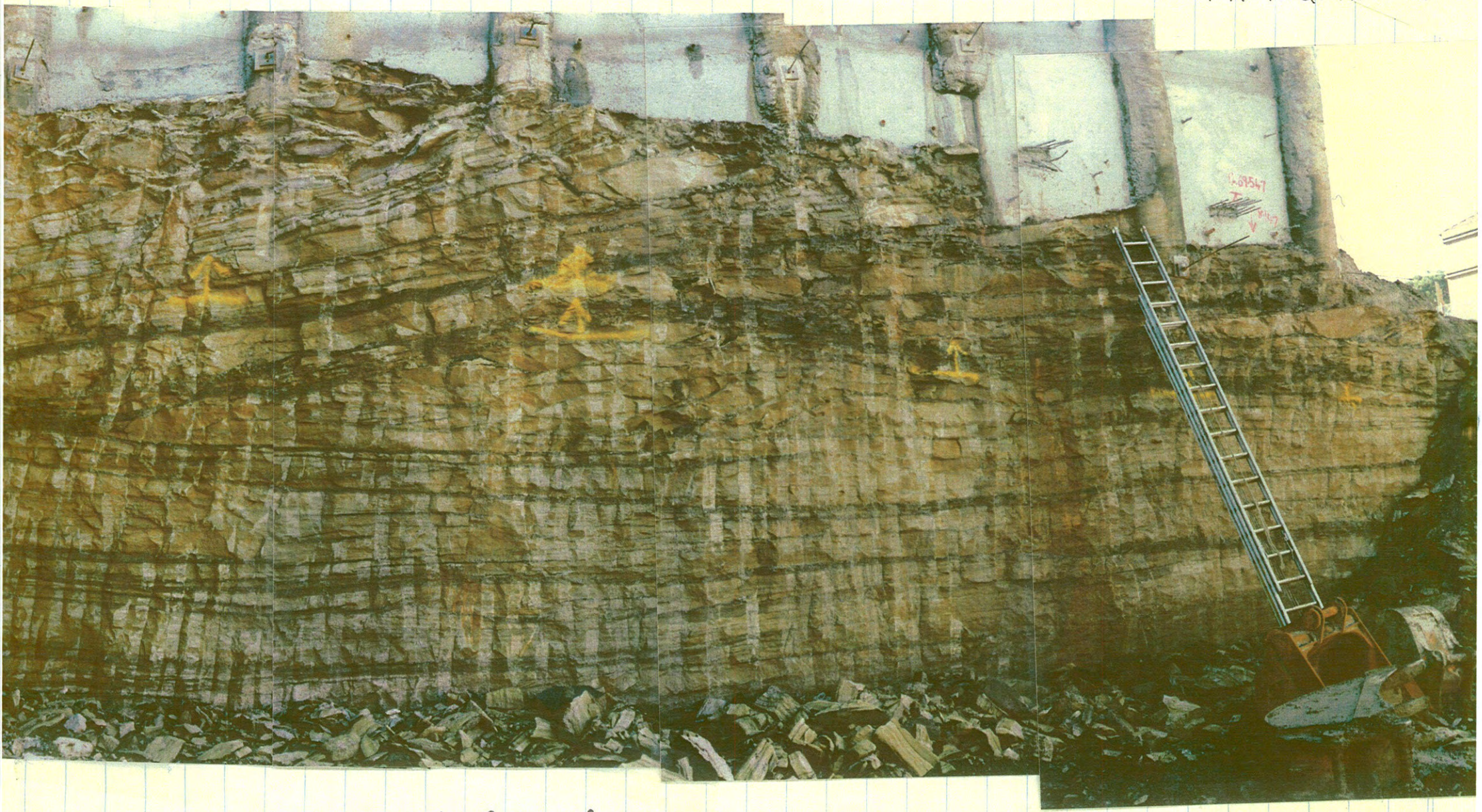
Report No. 24004WN Figure No. 1



Initial Excav. for
underpinning near
corner
26/2/88

SITE 3
RECORD
PHOTOGRAPH 1

SITE 3
RECORD
PHOTOGRAPH 2



West Side of 729 Club - detailed view

14/4/88.

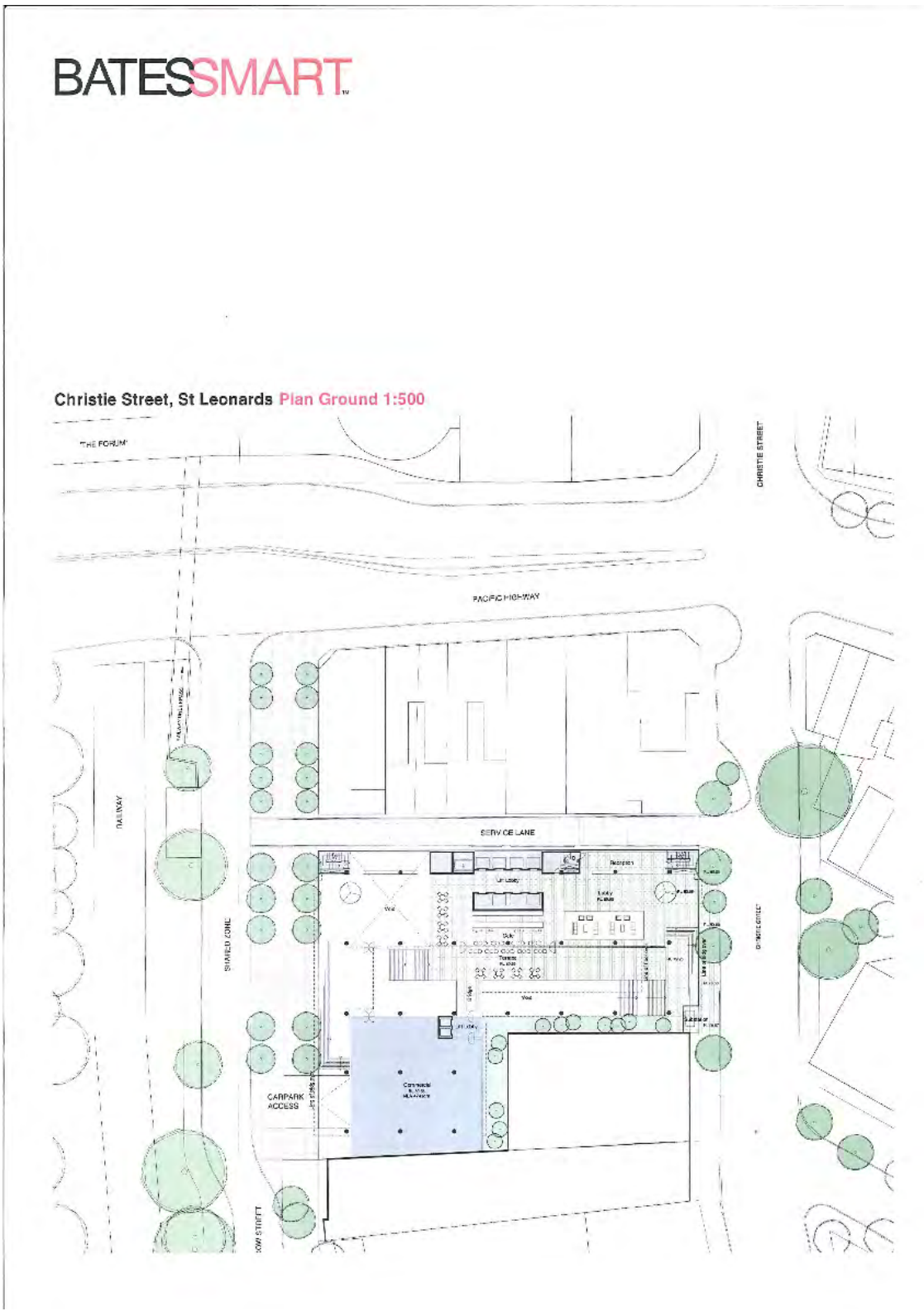
North Side with adjacent site.

14/4/88

SITE 3
RECORD
PHOTOGRAPH 3

Appendix B

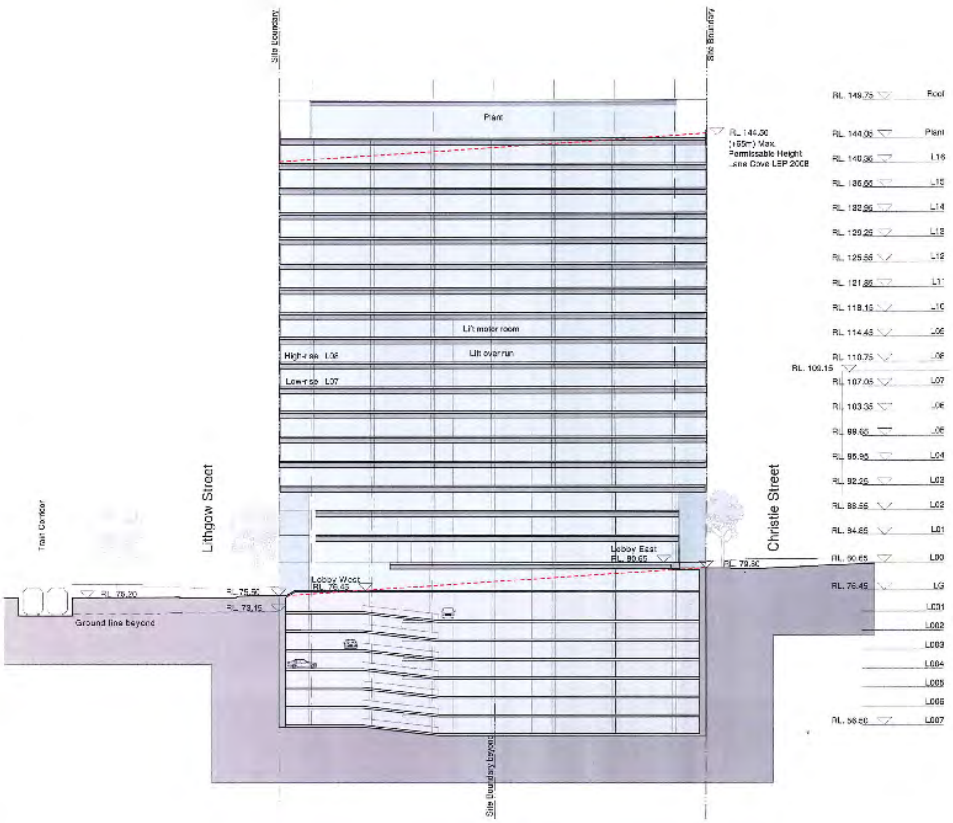
Architectural Plan and Sections



Plan at ground level

BATESSMART

Christie Street, St Leonards Section 1:500



Typical Cross-Section